

DOCUMENT RESUME

ED 249 246

TM 840 587

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TITLE Differential Effects of Note Taking Ability and
Lecture Encoding Structure on Student Learning.
PUB DATE Feb 84
NOTE 12p.; Paper presented at the Annual Meeting of the
Eastern Educational Research Association (West Palm
Beach, FL, February, 1984).
PUB TYPE Speeches/Conference Papers (150) -- Reports -
Research/Technical (143)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Academic Achievement; *College Students; Comparative
Analysis; Content Analysis; *Encoding (Psychology);
Higher Education; Language Processing; *Learning
Processes; Lecture Method; *Notetaking

ABSTRACT

The study examined the encoding function in student note taking in relationship to learning from a university lecture. It was expected that note taking effectiveness would be positively related to learning; and, that the notes of high and low effective note takers would differ significantly. After pretesting, a 551-word lecture on research methods was presented to an undergraduate human development class at the University of South Carolina. Immediately following the lecture, the notes of all 49 students were collected and a 10 item objective posttest was administered. The notes were examined on three measures of the lecture's 26 idea units and four encoding transformation indicators. The notes of high and low effective notetakers were compared. Results indicated support for both hypotheses suggesting that effective note taking as an activity, and independent of note review, is positively related to learning and does involve a semantic encoding function which appears to be required for comprehension level learning. (Author/BS)

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ED249246

Differential Effects of Note
Taking Ability and Lecture Encoding
Structure on Student Learning

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West Palm Beach, Florida
February, 1984

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contributed equally to the research of this study.

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(ABSTRACT)

The study examined the encoding function in student note taking in relationship to learning from a university lecture. It was expected that note taking effectiveness would be positively related to learning; and, that the notes of high and low effective note takers would differ significantly. After pretesting, a lecture on research methods was presented to an undergraduate human development class. Immediately following the lecture, the notes of all 49 students were collected and a posttest was administered. The notes were examined on several measures and the notes of high and low effective note-takers were compared. Results indicated support for both hypotheses suggesting that effective note taking as an activity, and independent of note review, is positively related to learning and does involve a semantic encoding function which appears to be required for comprehension level learning.

The lecture method remains a widely used approach in university teaching and student note taking generally accompanies this mode of instruction. Note taking may serve one or both of two functions. Several studies indicate that the activity of lecture note taking itself provides an encoding function in which lecture information is transformed by the student into a more meaningful form and thus facilitates learning. (Divesta and Gray, 1972, 1973; Aiken, Thomas and Shennum, 1975; Annis, 1981). However, the results of other studies suggest that note taking by itself is not as beneficial to student learning as note review indicating an external memory function of lecture notes (Eisner and Rhode, 1959; Peters, 1972; Fisher and Harris, 1974; Carter and Van Matre, 1975). What remains unclear is precisely how each of these two functions contribute to student learning outcomes under varying conditions.

It has been proposed that in order to explain several inconsistent results from previous studies on the relative importance of the encoding and external memory functions, researchers must more carefully examine individual differences in note taking techniques (Howe, 1975; Rickards and Friedman, 1978). What seems particularly important for advancing an understanding of note taking behavior is both a qualitative as well as quantitative analysis of the notes taken by students. Yet, to date, very little research has focused on such analysis.

In the only study approximating a lecture note analysis, Howe (1970) investigated the relationship between student note taking and delayed recognition of information from a short prose passage of a modern novel. Howe reported that the probability for students demonstrating recognition of information appearing in their notes was .34 in contrast to .05 for information not in their notes. He also reported that efficient note taking

(defined as the maximum number of meaningful information units recorded with a minimum number of words) was significantly related to student recognition of information. Although noteworthy as a pioneering effort, Howe's investigation has limited significance due to several methodological difficulties. The sample included only 26 subjects. The reading of a short passage from a modern novel as the material of the instructor's presentation suggests problems of external validity since this would seem to depart significantly from a realistic lecture situation. The use of a delayed test as the only dependent measure raises questions of internal validity since students may have reviewed the novel passage during the interim period.

The purpose of the present investigation was to examine the relationship between student note taking and learning in a more realistic college lecture situation with a specific focus on the encoding function. If encoding is an important function in effective lecture note taking activity which, in turn, does facilitate learning, then two predictions seem warranted: 1) Lecture note effectiveness should be positively related to learning and 2) there should be some qualitative as well as perhaps quantitative difference between the notes of high and low effective note takers.

Method

Subjects and Materials

The subjects were forty nine University of South Carolina undergraduate students in one section of a human development course taught in the spring semester 1983. All subjects agreed to participate and no extra credit was offered or given for participation. The experimental lecture. consisted of 551 words and 26 idea units (IU's) on research methodology in the behavioral sciences. Of the 26 IU's, 12 were identified as being most

important or primary while the remaining 14 were labeled supportive or related. All of the lecture material was selected for being a routinely integral part of the course content and students were assured in advance that they would be responsible for all of the lecture content over which they would be tested on the course final examination. In this way it was expected that student motivation for note taking would be enhanced and some measure of external validity for the experimental lecture and posttest situation preserved.

Procedure

On the first class meeting S's were given a course pretest to assess their entering knowledge of the course content and subject matter of the experimental lecture. On the second class meeting, students were told that a guest lecture would be presented that day and that immediately after the lecture their notes on the lecture would be collected and that they would be given a short examination on the lecture content. The nature of the short test (i.e., essay or objective) was not explained. Students were advised to do "the best they could" in taking lecture notes which would be examined and returned at the next class meeting. Immediately after the lecture, S's lecture notes were collected and then the short examination on the lecture material was administered.

Measures

Learning was assessed by a 10 item objective test which directly measured recognition for each of the 12 primary IU's. Each set of lecture notes was graded by two independent raters on several dimensions. Lecture note taking effectiveness was assessed in three ways: 1) The percentage of total 26 IU's correctly stated or identified (General Note Taking Effectiveness); 2) The percentage of the total 12 primary IU's correctly stated (Primary Note

Taking Effectiveness); 3) The percentage of the total secondary or related IU's correctly stated or identified (Secondary Note Taking Effectiveness). In addition the lecture notes were graded for Note Taking Efficiency according to Howe's (1970) formulation (i.e., the number of correctly identified IU's divided by the total number of words in the notes).

The lecture notes were also analyzed for several encoding transformation indicators which included: 1) Total Examples or elaborations of IU's; 2) Total number of word abbreviations; 3) Total number of emphasis marks (i.e., underlines, asterisks, stars, circles used to highlight IU's); 4) Total number of quantifiers (enumerations, and symbols which ordered subordinate with superordinate IU's).

Results

The hypothesis that lecture note taking effectiveness would be positively related to learning outcome was strongly supported. Correlation analysis on all measures of lecture note taking effectiveness as well as efficiency with scores on the objective post test are presented in Table 1. These results corroborate Howe's (1970) earlier finding that note taking efficiency is significantly related to learning with the difference that in the present study learning was tested by an immediate rather than delayed post test thus isolating the effects of the encoding function. However, the most significant relationship found was that between learning and Primary Note Taking Effectiveness (i.e., note taking effectiveness for the major idea units).

Further support for this first hypothesis was yielded from conditional probability analysis. Here, the major question addressed was whether or not the probability of a student getting a specific item on the post test correct depended on whether or not the IU or IU's tested by that item appeared in the

student's notes. To determine answers to this question, two types of conditional probabilities were calculated using similar procedures described by Bretzing and Kulhavy (1981). The index $P(R/N)$ indicates the probability for a student's correct recognition of idea units when those idea units were correctly recorded in his or her notes. The index $P(R/NN)$ indicates the probability for a student's correct recognition of idea units when those IU's were not found correctly identified in the student's notes. These two conditional probabilities were calculated for all note takers on each item with the resulting proportions transformed to arc sines to stabilize variances and normalize data (Winer, 1971).

Separate correlation coefficients were computed for both $P(R/N)$ as well as $P(R/NN)$ arc sines and item discrimination values. Although the correlation between $P(R/N)$ and item discrimination value was not significant, the correlation obtained for $P(R/NN)$ and item discrimination value was $r = -.89$ which produced an $F_{(1,8)} = 30.2$, ($p < .001$) on the test of significance. This result clearly suggests that as item difficulty increases, the probability of a student correctly recognizing idea units tested in items without those same idea units correctly recorded in the student's notes, decreases.

In order to further examine these relationships, each of the 10 items was classified into high and low difficulty categories (5 items in each) and a 2 (Item difficulty) $\times$ 2 (probability type) ANOVA with repeated measures on both factors was conducted. A significant main effect was found for both probability type ($F_{(1,17)} = 23.98$, $p < .0001$) and Item difficulty ($F_{(1,17)} = 20.6$, $p < .0005$), however the anticipated interaction did not reach significance ($F_{(1,17)} = 1.02$, $p > .1$). The highly significant main effect for probability type strongly indicates that the probability of a student correctly

recognizing important lecture idea units on an immediate post test very much depends on those idea units being correctly recorded in his or her lecture notes.

Support was also obtained for the second hypothesis which predicted that if encoding is an important function in note taking activity which facilitates learning, then some difference(s) would likely exist between high and low effective note takers. In order to test this prediction, the notes of the 10 students who scored 90% or above on the objective test and who were graded as effective note takers (mean percentage of correct IU's=.785) were compared with the notes of the 10 students who scored 50% or 60% on the objective test and who were graded as ineffective note takers (mean percentage of correct IU's=.611). Surprisingly the average number of words recorded per lecture note set was almost the same for both groups (244.1 for the high group, 243.8 for the low group). Additional comparisons were made on the following ratios: 1) Total emphasis markings (underlines, asterisks used to highlight IU's) divided by the average number of words per IU, denoted as (E); 2) Total word abbreviations divided by the average number of words per IU, denoted as (A); 3) Total enumerations (numbers, letters, or symbols used to structure lists of subordinate IU's) divided by the average number of words per IU, denoted as (EN). Two tailed t tests were significant for (E) [$t=2.00$, $df=12$ (adjusted for unequal variances), $p < .10$] and for (A) ($t=1.42$, $df=18$, $p < .10$) but not for (EN) ($t=1.42$, $df=18$, $p > .10$). Thus in relation to the average words used per idea unit, the high group students used a significantly greater number of word abbreviations and emphasis markings apparently for encoding important points and ideas more efficiently and effectively.

Discussion

The general findings of the study indicate: 1) Effective and efficient lecture note taking is an important mathemagenic activity (Rothkopf, 1970) which facilitates college student learning in the context of the lecture format of instruction. 2) Moreover, effective and efficient lecture note taking does involve an encoding function by which lecture information is transformed into some meaningful format. An observation shared by both raters of the lecture notes was the view that despite the commonalities between all the lecture note sets, each set of notes was indeed unique in style, technique, word order arrangement and use of space on note pages suggesting that one's lecture notes may be as personalized as one's signature. Although students had the opportunity to record the lecture almost verbatim, none of the students did this. Each student seemed to impose some degree of encoding structure between listening to the lecture and recording notes, and the more effective note takers appeared to transform the lecture material with a greater focus on what they believed was most important.

The results of this study however stand in sharp contrast to a statement made by McAndrew (1983) in a recent review of notetaking research. In this article the author states:

One reason for the failure of the process of encoding notes to produce significant effects on later recall is that little encoding actually occurs. (p. 105).

Obviously any adequate resolution to the conflict between this view and the implications from the results of the present study will require additional research in note taking analysis which isolates the effects of the encoding function.

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TABLE 1

Correlation Coefficients for Measures of Lecture
Note Taking and Test Scores

	PRE	GNTE	PNTE	SNTE	NTEF	POST
PRE	...	...	...	...	...	...
GNTE	.21	...	...	...	...	...
PNTE	.25	.82***	...	...	...	...
SNTE	.07	.83***	.49***	...	...	...
NTEF	.41**	.21	.17	.20	...	...
POST	.19	.35**	.48***	.31*	.29*	...

*p .05
**p .01
***p .001

PRE - Pretest Scores
POST - Posttest Scores
GNTE - General Note Taking Effectiveness
PNTE - Primary Note Taking Effectiveness
SNTE - Secondary Note Taking Effectiveness
NTEF - Note Taking Efficiency